National Oceanic and Atmospheric Administration - Center for Earth System Sciences and Remote Sensing Technologies (CREST)

- Inter-disciplinary science & engineering in alignment with NOAA Science mission

- Education & Diverse Workforce Development in alignment with NOAA Education Mission
NOAA-CREST History

• **In existence** since 2001 through major funding by NOAA Educational Partnership Program (EPP)

• **Overarching Goals** – conduct **research** in NOAA related science in collaboration with NOAA and many others....

• **Education** - **recruit, train, educate and graduate** students especially from underrepresented communities in NOAA related sciences, and **public outreach** to help increase environmental literacy and help increase STEM workforce

• **17+ years of capacity building** – Science, Training and Infrastructure
NOAA’s role in science education is clearly defined in the America COMPETES Act. NOAA Education Strategic Plan focuses on the **Diverse Workforce Development**

CREST Lead Institution - The City College of NY

Partner Institutions:
- Hampton University, VA
- University of Maryland, Baltimore County, MD
- University of Puerto Rico, Mayaguez, PR
- California State University of Los Angeles, CA

By The Numbers

550 students impacted/trained
(307 - Funded || 243 Leveraged)
307 of 550 enrolled during 2011-2018
(184=Funded || 123 Leveraged)
282 of 307 graduated during 2011-2018
(164 = Funded || 118 = Leveraged)

By Diversity

419 of 550 URM students impacted (76%)
221 of 307 enrolled URM students (72%)
131 (funded) and 90 (Leveraged)
197 of 307 URM graduates (64%)

By Gender

119 of 307 Funded (39%)
75 of 243 leveraged (31%)
188 of 307 Funded (61%)
166 of 243 leveraged (68%)

A Multidisciplinary Program
- Engineering (64%)
- Physical Sciences (12%)
- Geo-sciences (5%)
- Life Sciences (3.5%)
- Math and Applied Math (2.5%)
- Other (12%)

282 Degrees Awarded (2011-2018)
151 out of 268 peer reviewed journals published by CREST students

Research Themes
- Climate
- Weather & Atmosphere
- Water Resources & Land Surface Processes
- Ocean & Coastal Waters
- NOAA Collaborators
- NESDIS (primary)
- Other: NWS, OAR, NOS
- Private Sector Partners
  - IMSG, Inc.
  - ERT Inc.
  - Northrop Grumman
  - Raytheon
  - SSAI Inc.
- Leveraged Funds
  - $11.23M Research & Education grants

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CREST 2016-2021 Research Themes

Coastal Resilience

Atmospheric Hazards

Water Prediction & Ecosystem Services

Photo Credit: Mike Shanahan, TNC

Hurricane Harvey at Peak Intensity
Photo Credit: NOAA

Photo Credit: NOAA
CREST Ocean Observatories in Critical Coastal Regions

Quantifying Coastal Erosion in the Arctic, and Assessing Impacts on Vulnerable Coastal Ecosystems and Communities

Development of Coastal Water Quality Indicators

Development of In-situ and Satellite-based Environmental Datasets for Assessing Resilience to Disturbance in Tropical Coral Reefs

Improved monitoring of Harmful Algal Blooms (HABs) and their Impacts in Coastal Eutrophic Systems

National Ocean Services
NESDIS
NEDIS/Coral Reef Watch Team
Atmospheric Hazards

Severe Storm Prediction

Heat Stress and Urban Modeling

Satellite Validation and Analysis

The CREST Earth System Observing Network (CESON) and Applications

NESDIS
OAR/ESRL/CSD/GSD
NWS
### Water Prediction and Ecosystem Services

<table>
<thead>
<tr>
<th>Drought Risk Assessment Using Demand Data and Remote Sensing Products</th>
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<tbody>
<tr>
<td>Flood Risk Assessment Using In-situ Data and Remote Sensing Data Products</td>
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<tr>
<td>Assessment and Improvement of National Water Model Development and Validation of the Snow Data Product</td>
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<tr>
<td>Monitoring Land-Atmosphere-Ocean Fluxes</td>
</tr>
<tr>
<td>Development of Sensors for Unmanned Aircraft Systems (UAS) platforms for Environmental Intelligence and Satellite Product Validation</td>
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**Organizations:**
- NESDIS
- OAR/ESRL/PSD/GMD/GSD
- NWS
Identify Center’s need and improve its understanding of how end-users and other stakeholders besides NOAA use the data and information that the Center produces.

Conduct Stakeholder’s workshops – NY and PR region (as an e.g.)

Create a participatory listing and ranking of the (1) Ecosystem Services Changes, (2) Identify the key drivers of changes, and (3) how it aligns with NOAA’s Mission of Science Service and Stewardship.


| NOS | NESDIS | OAR (ESRL – PSD, GMD, GSD and CSC) | NWS | NMFS |
NOAA CREST Facilities and Opportunities

Satellite Earth Observation System

CREST LIDAR NETWORK

Field Campaigns - Water Sampling

AEROSE Expedition, on NOAA Ship – Ronald H. Brown
The five Elements of Students Career Success Pathways

Individualized Student Development Plan (iSDP)

Professional Networking and Career Planning (Seminars, Workshops, brown bags; retreats)

Peer-based mentoring; Community Engagement and Public Outreach; Social Science Integration

Research Training and Publications (Ethical Conduct of Research training; Soft Skills Development – Verbal/written Communications)

Summer-Bridge Undergraduate Research Experience (SURE) to prepare potential NOAA undergraduate scholarship applicants

Professional Advancement and Career Engagement (PACE)
13 Students completing NERTO
53 Students will receive CWCC training prior to graduation
31 graduates (18 MS and 13 PhD) getting Social Science mentoring
53 students (cohort I and II) continues to receive research mentoring and training
7 Students will graduate by end of summer
3 Students received job offers
Student Scholarship Internship Opportunity (SSIO) – NOAA Experiential Research and Training Opportunity (NERTO)

- NERTO provides value to Students, the Cooperative Science Centers and to NOAA

- CSC students participate in 12-week meaningful NOAA mission-aligned STEM, policy, natural resource management, and social science research and training at various NOAA facilities

- CSC supported students earn NOAA mission-aligned postsecondary degrees
NERTO: Standard Operating Process

1. Identify - NOAA mentor/project
2. SSIO project development by NOAA mentor (https://oedwebapps.iso.noaa.gov/ssio/)
3. NOAA EPP Program shares the SSIO with CSC
4. Student apply to the SSIO - 12 week workplan
5. SSIO plan is submitted by CSC director to NOAA/EPP and Mentor
6. SSIO award letter issued by NOAA mentor, badging process begins, student begin NERTO

NERTO: 2018 updates

- Provides value to Students, the Cooperative Science Centers and to NOAA

- 13 graduate students doing NERTO (summer 2018)
- Two graduate student successfully completed
- 13 NOAA mentors, 9 NOAA locations
Center for Earth System Sciences and Remote Sensing Technologies
Strategic Approach to Successful NERTO Planning and Execution

• **Proactive Approach** planning ahead of time – to manage scope and expectations of NERTO opportunities each year (recruitment plan and developing student project)

• Online Student **E-portfolio System** (center wide)

• Student creates an **Individualized Student Development Plan (ISDP)** within 90 days of their recruitment in the program

• **Regular monitoring/interaction** by the CSC education team and the Center leadership team

• Identifying and defining the **NERTO plan** (communication and coordination between Graduate Students, NOAA mentors, CSC Advisors with guidance and support from NOAA Technical Monitor and NOAA Program Office)
NERTO – Locations for EPP CSC supported Students

Summer 2018:
12 NERTO cohort I
1 – cohort II

Fall 2018:
3 NERTO cohort I
1 Cohort II

Summer 2019:
~5 (cohort II)

- NOAA/NESDIS/STAR, NCWCP Facility, College Park, MD
- NOAA/NOS/Hollings Marine Lab, Charleston, SC
- NOAA/NWS/RFO, San Juan, Puerto Rico
- NOAA/OAR/ESRL, NOAA/NOS/NGS, Anchorage, AK
- NOAA/OAR/GMD Hilo, HI
- NOAA/NWS/RFO, Chanhassen, MN
- NOAA/NOS/NMSAS,Pagoa, American Samoa
- NOAA/OMAO/AOML, Miami, FL
Students Satisfaction with their internship experience

- Application of previous course knowledge to their internship
- Interaction with NOAA mentors
- New skills acquired
- Supervision & feedback from NOAA
- Internships aligned or helped with their ongoing graduate research

Bar graph showing percentages from 0% to 100% for each category.
Benefits of participating in a NOAA internship

- Preparation for more advance research
- Confidence in ability to conduct research
- Skill sets in interpreting research data
- Better understanding of research
- Clarify career path
Benefits and Outcome of the NOAA Internships – NERTO (Qualitative Assessment)

- **NOAA Know-how**: Students have a better understanding of NOAA mission sciences.
- **Shift in the Paradigm**: Focus on NOAA Mission Aligned Sciences
- **User-Inspired Research**: Social Science & Science nexus, Operational Research
- **Enhanced NOAA Collaboration and Engagement**
- **Enhanced Opportunities to join NOAA Enterprise Workforce** for CSC graduates through postdoctoral and/or NOAA and other federal contractual jobs.
- **Increased Professional Networks** across the nation.
Early NOAA Engagement

• NOAA Emerging Technologies for Observations Workshop, August 22-23, 2017 (Use of UAS and Drones for Earth System Observations)
• National Water Center, Tuscaloosa, AL – October 27, 2017
• Collaborative engagement during R2O workshop organized by OAR/OWAQ Office (John Cortinas) – November 2, 2017 (Collaboration on Integration of Soil Moisture and Snow Water Equivalent Data Product into the National Water Model)
• National Weather Service/Regional Forecast Office, San Juan, PR, February 27, 2018 (Collaboration on Surface Wave Heights and Coastal Inundation and Flood Forecasting in PR Island)
• NOAA/OAR/ESRL/Physical Science Division, March 2018 (met during 9th NOAA EPP forum) and follow-up group conference call on April 24, 2018. (Collaborations on National Water Model, Integrated Soil Moisture Network, Drought Index/outlook, and Food Security and Hydrologic Extremes)
• NOAA/NMFS/SWFC, Santa Cruz (conference call April 24, 2018) (Collaboration on impact of climate/water extremes on fish productivity)
Outcome (wish list!!)

• Research Collaborations
  • Science
  • Social Science
• Joint Proposals
• Seminar Series
• Workshops/Seminars/Conference presentations (AMS/AGU)
• NERTO opportunities
• Join Post-doc opportunities